

Solar Energy

97/02951 a-Si:H/a-Si:H stacked cell from VHF-deposition in a single chamber reactor with 9% stabilized efficiency

Platz, R. *et al.* *Solar Energy Materials and Solar Cells*, 1997, 46, (2), 157-172.

Results on a-Si:H/a-Si:H stacked cells deposited in a single-chamber reactor by the very high frequency-glow discharge (VHF-GD) deposition technique at 70 Mhz are presented. Regarding the stacked cell design, experimentation and simulation indicate the importance of careful adjustment to the current mismatch between the component cells in order to obtain a slight top-cell-limited behaviour after degradation. An a-Si:H/a-Si:H stacked cell with an initial efficiency of 9.8% showing only 8% relative degradation is introduced. A stabilized efficiency of 9% is therefore attained. Consequently, it is possible to make highly efficient stacked cells showing good stability in a single-chamber system, employing the VHF technique for higher rates.

97/02952 Bond graph modelling and simulation of spice-pounding machines fed from a photovoltaic source

Madansure, V. N. *et al.* *Int. J. Energy Res.*, 21, (8), 695-706.

The paper explores the dynamics of intermittent load systems fed from a PV source, led by the expanding application of PV power in diverse areas. Most actual loads in small-scale village industry are intermittent and pulsating. For successful application of photovoltaics in these areas, the dynamic behaviour of such systems must be understood. This requires the formulation of dynamic models of PV-fed intermittent load systems. Bond graph methodology has recently emerged as a very convenient tool for dynamic modelling. This is the first application of this methodology in modelling photovoltaic systems. The spice-pounding operation is taken as a typical example of a pulsating load that can be fed from PV power. It is shown that the standard equivalent circuit of the PV cell gives rise to algebraic looping problems when expressed in the language of the bond graph. Means of overcoming the problem have been suggested. This is the first report of modelling the spice-pounding machine with the bond graph technique. The model has been simulated with COSMO-KGP software and the results reported. It is found that the dynamic behaviour of the PV-fed spice-pounding system differs significantly from that of a system fed from a constant voltage supply. Performance is compared for a shunt motor, a series motor and a separately excited motor, and three types of cam profiles, namely parabolic, cycloidal and half harmonic plus constant velocity.

97/02953 Computer modelling of current matching in a-Si:H/a-Si:H-tandem solar cells on textured TCO substrates

Zeman, M. *et al.* *Solar Energy Materials and Solar Cells*, 1997, 46, (2), 81-99.

The title cells were optimized using computer modelling on textured substrate in order to achieve current matching between the top and bottom cell. A multi-rough-interface optical model which was used for calculating the absorption profiles in the tandem cells is introduced. In order to simulate multi-junction solar cell as a complete device we implemented a novel model for tunnel/recombination junction (TRJ) is presented. The influence of light scattering and thickness of the intrinsic layer of the bottom cell on the optimal ratio i_2/i_1 between the thicknesses of the bottom (i_2) and top (i_1) intrinsic layers in the current-matched cell. The simulation results are reported.

97/02954 Constant delivery temperature solar water heater—an integrated approach

Kumar S. and Kumar, N. *Energy Convers. Mgmt.*, 1997, 38, (1), 61-71.

Describes the development of an integrated model of a constant delivery temperature solar water heater-cum-active regenerative distillation system. The water used for the regenerative effect in the distiller of the proposed system is subsequently fed to the basin-cum-storage tank of the still through the heat exchanger. The water mass flow rate is varied to maintain a constant outlet temperature. With minor modifications in the solar water heater, the extra energy stored in the water mass due to non-utilization of capacity and/or non-linear utilization of capacity can be efficiently utilized for distillation purposes. In this process, the latent heat of vaporization is used for preheating the inlet water supply to the heat exchanger. The effect of insulation on maintaining the hot water temperature and distillate output is also presented.

97/02955 Continuous low-temperature dry carbonization of coal by solar energy

Wang, Zhuliang *Jiangsu Ligong Daxue Xuebao*, 1996, 17, (3), 36-41. (In Chinese)

A new type of oven for continuous low-temperature carbonization of coal by solar energy is discussed. Carbonization time was estimated and comparisons of all kinds of carbonization methods were carried out. The article discusses the advantages such as shorter carbonization time, energy savings and zero pollution, and that solar energy can be changed into chemical energy of tar and gas and stored in them. Trends concerning solar energy application to the field of coal transformation are outlined.

97/02956 CSHPSS systems in Greece: test of simulation software and analysis of typical systems

Argiriou, A. A. *Solar Energy*, 1997, 60, (3/4), 159-170.

In Greece, though solar domestic hot water (DHW) systems are very popular, active solar space heating remains marginal, largely due to the lack of experience of building professionals. Central solar heating plants with seasonal storage (CSRPSS) are promising systems. This article compares the design data of an interseasonal storage system in Greece with the results of two CSHPSS simulation software codes: MINSUN and SOLCHIPS. The comparison showed good agreement and therefore these user-friendly tools can be used with confidence for the design of CSHPSS under Greek weather conditions. The results show that CSHPSS, previously used mainly in northern countries, is also an interesting solution for southern climates. With the high solar fractions that CSHPSS achieve, their use can further reduce not only the conventional energy consumption of buildings, but also the associated CO₂ emissions that contribute significantly to the heavy pollution of Greek urban areas.

97/02957 Effect of solar collector design parameters—on the operation of solar Stirling power system

Singh, N. *et al.* *Int. J. Energy Res.*, 1997, 21, (2), 195-200.

In order to find out the optimum operating temperature for solar Stirling power systems, an analysis was conducted. The analysis has also clearly brought out the effect of solar collector design parameters, such as concentration ratio, overall heat loss coefficient, and heat engine parameter on the overall efficiency of solar Stirling power systems.

97/02958 Effects of auxiliary heater on annual performance of thermosyphon solar water heater simulated under variable operating conditions

Shariah, A. M. and Löf, G. O. G. *Solar Energy*, 1997, 60, (2), 119-126.

The TRNSYS simulation program was used to simulate a thermosyphon solar water heating system with electric auxiliary heater. Location of the auxiliary heater, inside the storage tank or connected in series between the system and the user, was studied using the TMY meteorological data for Los Angeles, California. Simulations were performed for two different water-load temperatures (60 and 80°C) and for two types of daily hot water volumes (250 and 150 l). Four types of daily hot water consumption profiles were used in the present study. The results show that if water is drawn on a schedule corresponding to the Rand draw profile, the system operates with higher efficiency when the auxiliary heater is located in the storage tank than when the auxiliary heater is outside the storage tank. The increase in solar fraction depends on the load profile and volume, temperature setting, as well as the quality of the collector and the storage tank volume.

97/02959 European solar radiation atlas. Solar radiation on horizontal and inclined surfaces

Palz, W. and Greif, J., Commission of the European Communities - Springer, 1996, 333pp.

The third revised and updated edition of the Atlas is presented. The revisions reflect the political developments in the EU and within neighbouring countries and an introduction to the systematics of solar radiation measurement and calculation are presented. The solar data presented is a useful source of information for the estimation of the energy harvest potential for solar systems.

97/02960 Experimental performance of built-in-storage solar water heating systems in laboratory and field conditions

Sodha, M. S. *et al.* *Int. J. Energy Res.*, 1997, 21, (3), 275-287.

Three designs of built-in-storage solar water heating systems of 100 litres capacity each were monitored for hourly thermal performance, both in laboratory and field conditions. A different storage tank design is used in each of the three cases. Design I consists of three tanks connected in series; in Design II, a parallelepipedic tank is divided into five zones with baffles; Design III is a simple parallelepipedic tank. It is seen from the results that the performance of Design II is the best of the three.

97/02961 Heat transfer and fluid flow studies in the collector tubes of a closed-loop natural circulation solar water heater

Siddiqui, M. A. *Energy Convers. Mgmt.*, 1997, 38, (8), 799-812.

In order to obtain experimental data, studies on heat transfer and the resulting fluid flow through the collector tubes of a closed loop thermosyphonic solar water heater have been conducted at Aligarh. The data, in terms of temperatures, were collected for hot water withdrawal rates of 0, 50 and 60 l/h on various days. The local and length averaged heat transfer coefficients were calculated for some tubes on the collector using the global radiation recorded near the heater. Various dimensionless parameters governing the heat transfer and the fluid flow were subsequently estimated. The collector efficiency and flow factors were made the bases for selecting the data and standardisation of the system under study.

97/02962 High efficiency solar air heater

Mohamad, A. A. *Solar Energy*, 1997, 60, (2), 71-76.

A novel type of solar air heater is presented. Heat losses from the front cover of the collector should be minimized, while heat extraction from the absorber is maximized. This can be done by forcing air to flow over the front glass cover before passing through the absorber. This design therefore needs an extra cover to form a counter-flow heat exchanger. The use of a